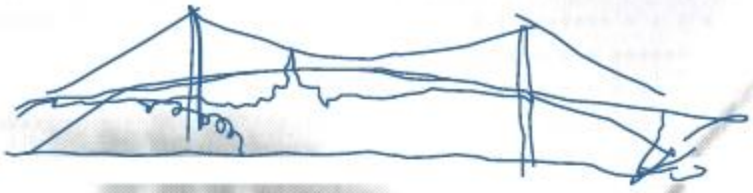
UNIVERSITÄT
DUISBURG
Campus Duisburg

Department of Engineering Sciences
Division of Mechanical Engineering
Transport Systems and Logistics
Lotharstraße 1 - 21
47057Duisburg

Phone: 0203379-2785
Fax: 0203379-3048
eMail: b.noche@uni-duisburg.de



Prof. Dr.-Ing. Bernd Noche

Simulation in der Logistik

ehem.: **Simulation in Logistics I**

Installation and Introduction of Dosimis 3

Lecturer: Prof. Dr.-Ing. Bernd Noche

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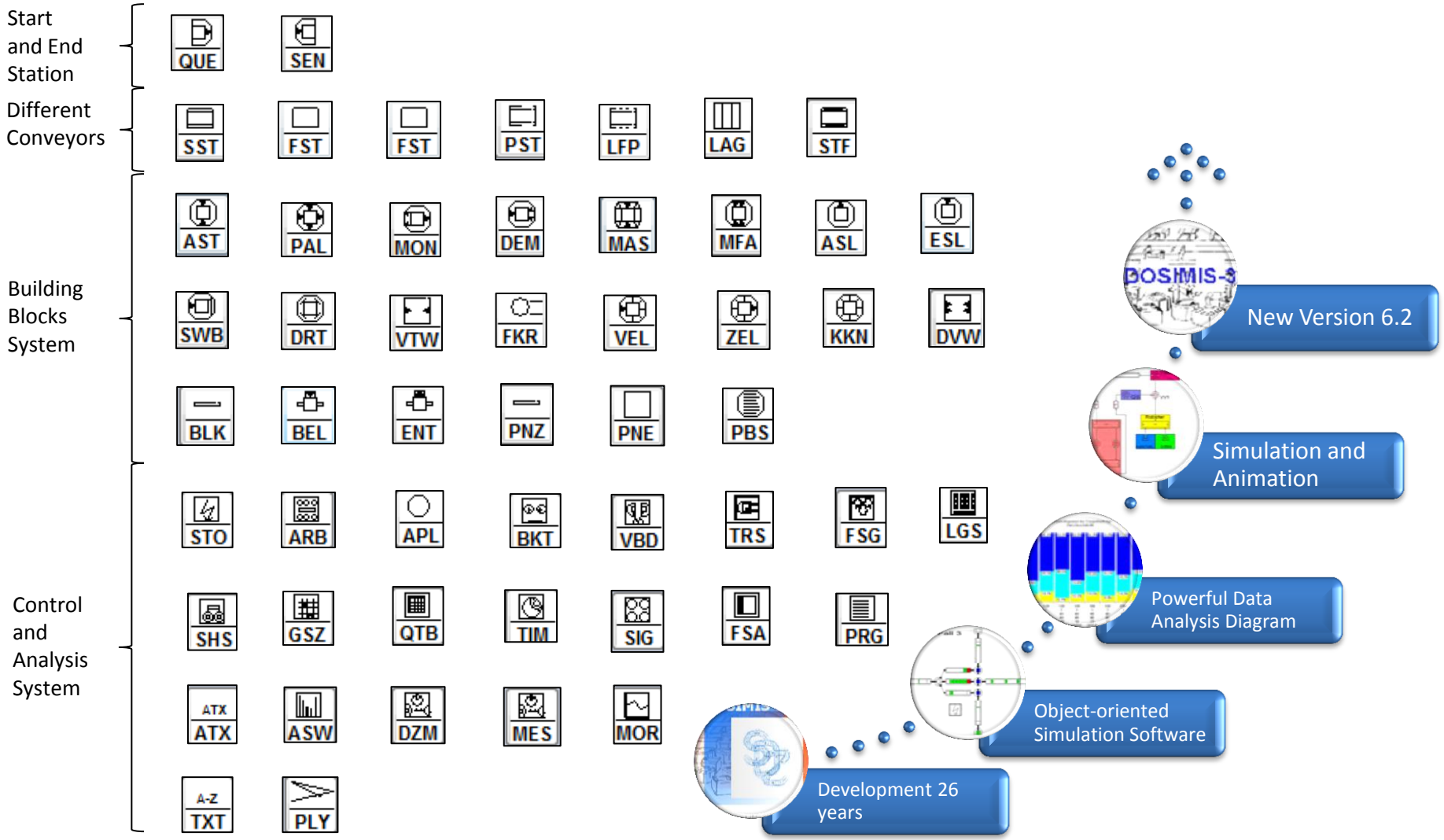
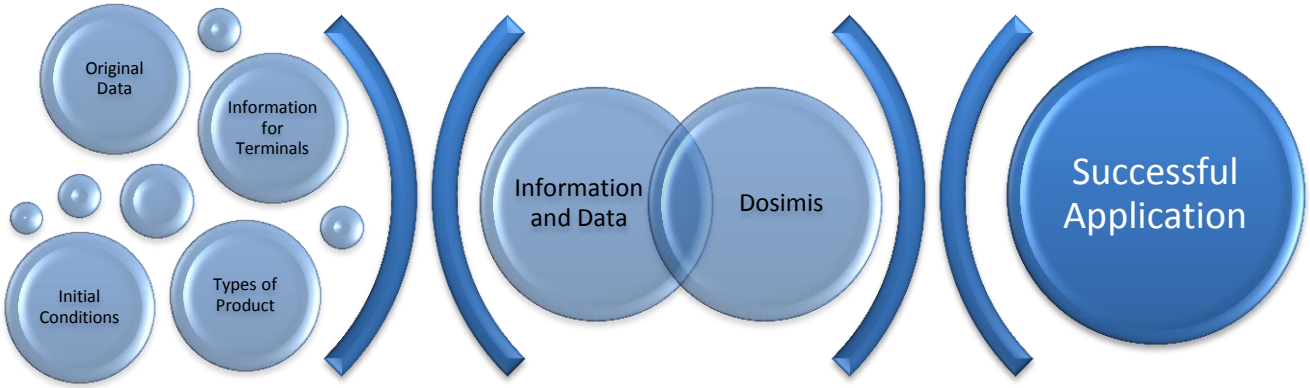
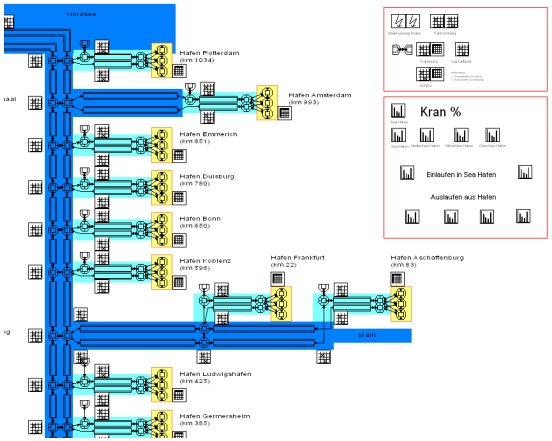
Introduction of Dosimis

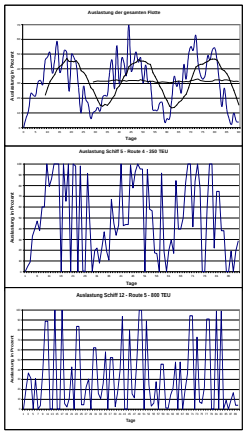


The Application of Dosimis



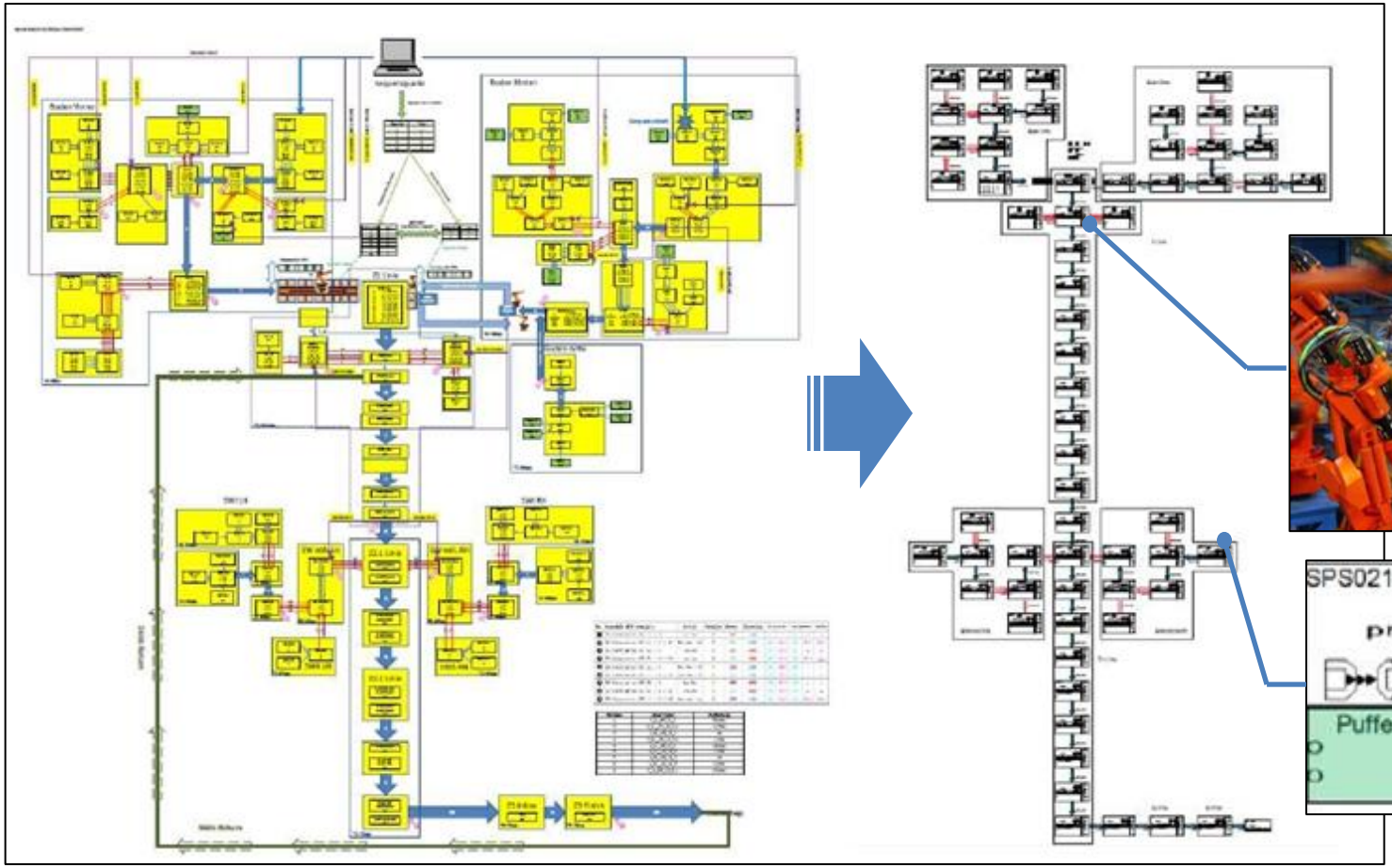
Simulation time = 70 days
Run Time = 15 days
Quantity of Sips = 12 (2 x 800 TEU, 6 x 500 TEU, 4 x 350 TEU)
Speed down river [m/s] = 7.0
Speed Upstream [m/s] = 4.0
Speed in Canal [m/s] = 6.0
Mooring Time in Port [min]= 70
Disposition Time in Port [min] = 30
Load / Unload / TEU [min]= 3
Transshipment Point … …





Analysis of Row Data | **Simulation with Dosimis** | **Optimization of Results**

Application for Production System



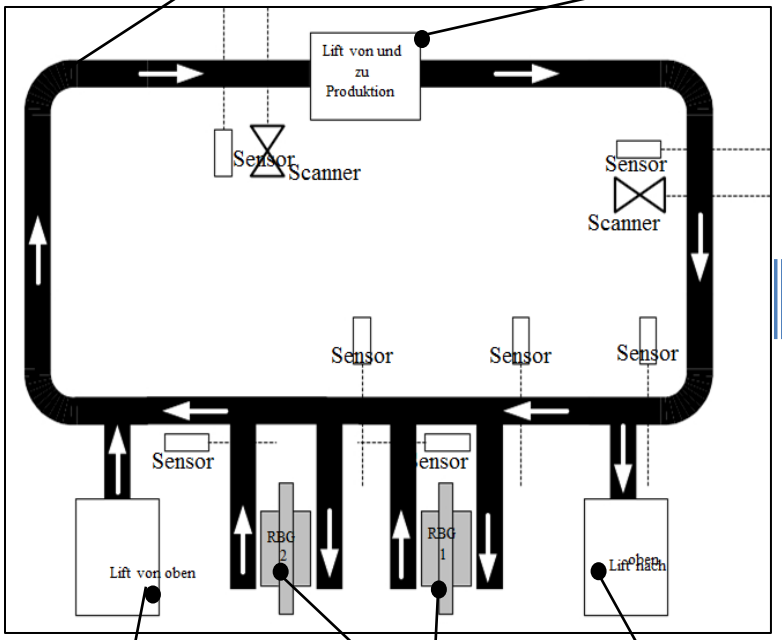
Blueprint, Design Paper, Drawing Paper and CAD Paper

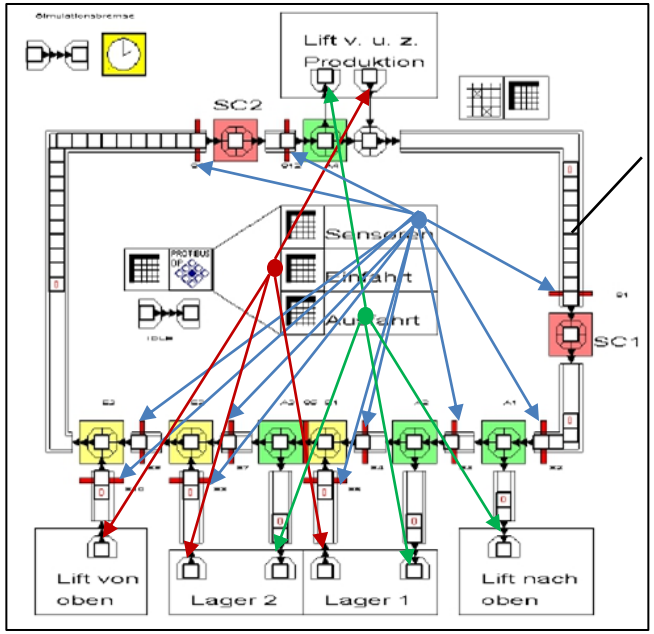
Dosimis Simulation

Application for Warehouse System

Accumulated Conveyor or Street …

Processing Machine





Nr. of Parkplace for Vehicle

Lift for Entrance

Warehouse 1 and 2

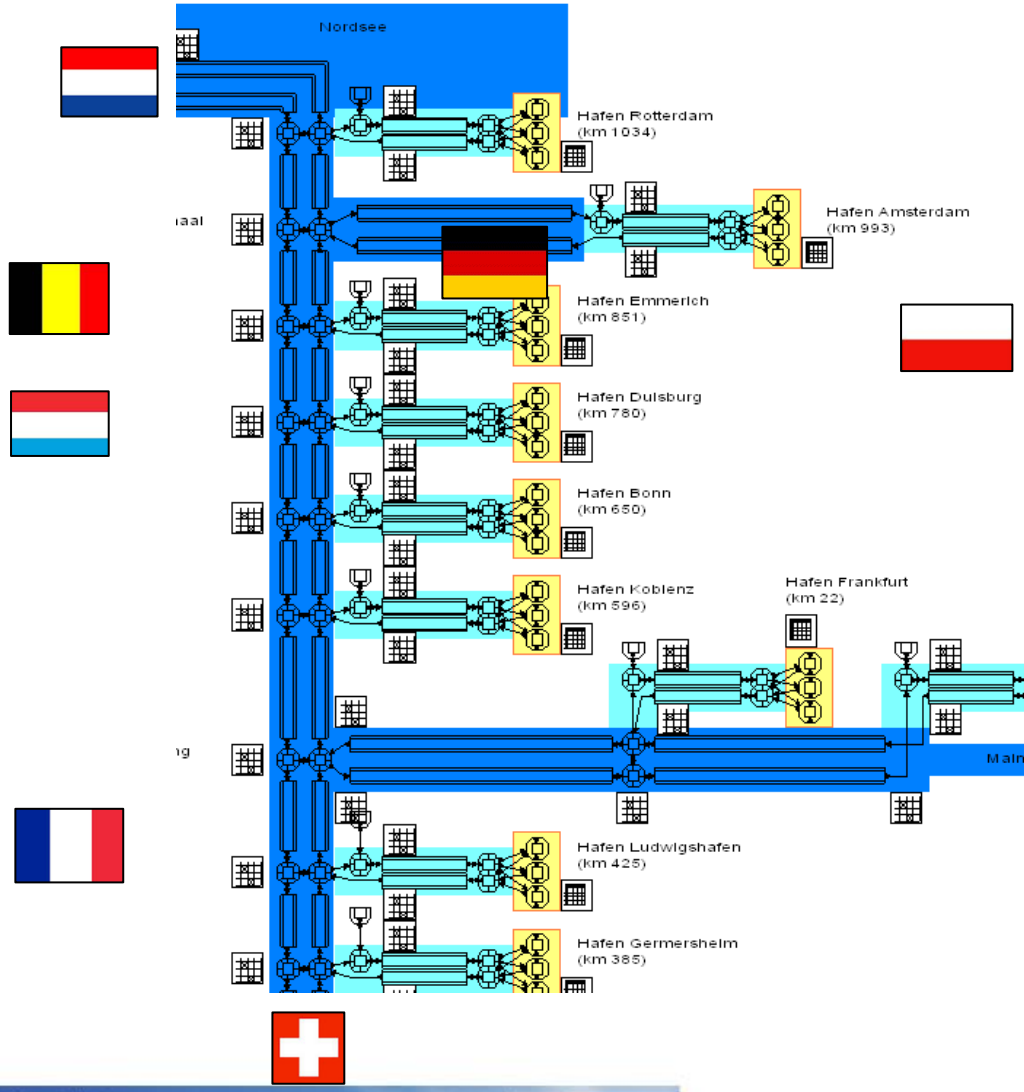
Lift for Exist

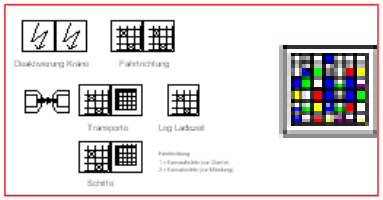
DT for Sensors

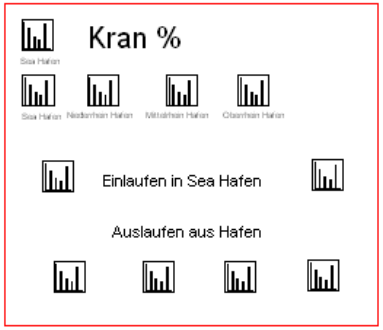
DT for Products Entrance

DT for Products Exit

Application for Transportation







Decision-Making Strategy

St.	Port	Quay Cranes
1	Amsterdam	0
2	Rotterdam	3
3	Antwerpen	3
4	Emmerich	1
5	Duisburg	3
6	Bonn	1
7	Koblenz	1
8	Frankfurt	1
9	Aschaffenburg	1
10	Ludwigshafen	1
11	Gemersheim	1
12	Woerth	3
13	Kehl	1
14	Strasbourg	1
15	Ottmarsheim	1
16	Weil	1
17	Basel	1

List of Contents

- Introduction in DOSIMIS-3
- Special elements of DOSIMIS-3
- Introduction in simulation runs and statistics

DOSIMIS-3

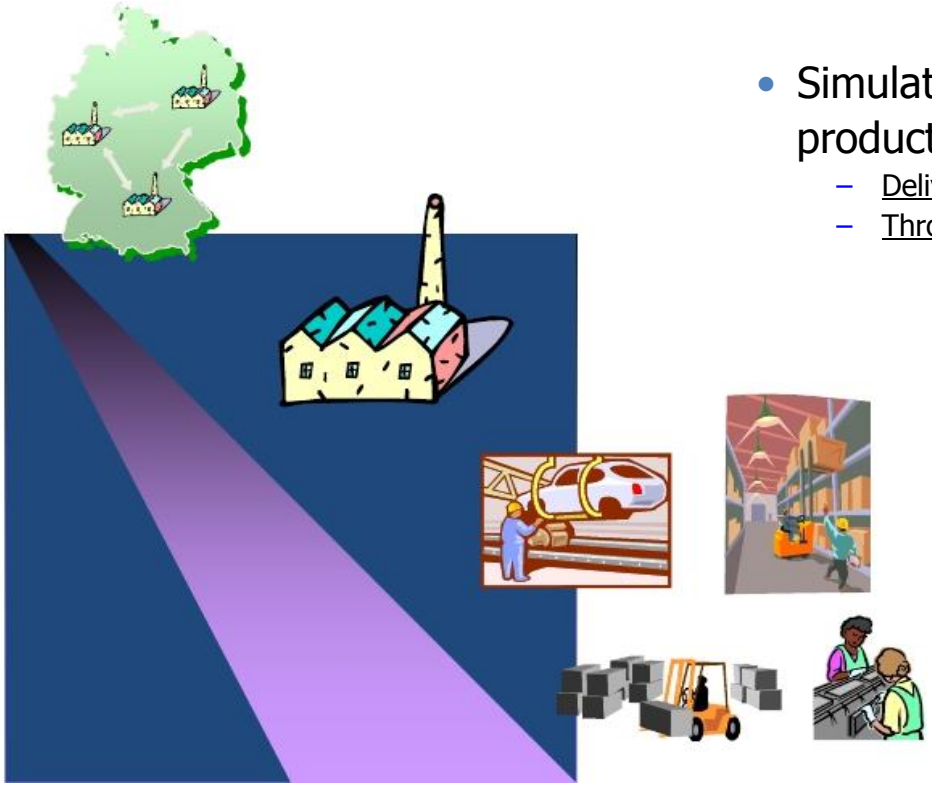
- DOSIMIS-3 is one of the fastest discrete simulationtools
- DOSIMIS-3 offers a rich component library to the user for the ranges production and conveying engineering and detailed results on push of a button.
- The users can define the parameter of elements quickly and easily by dialog boxes. Writing of source code to define the behavior is not necessary.
- In order to implement complex control algorithms, decisiontables are available to the user. With these control elements rules can be defined guided by menus.
- Practice orientated development of DOSIMIS-3.

- Areas of application
  - Simulation of material-, process- and personal flow in manufacturing systems, storage systems, transportation systems.

The integrated layer concept

- The questions determines the grade of abstraction of the model

- Supply-Chain
  - Concern strategies



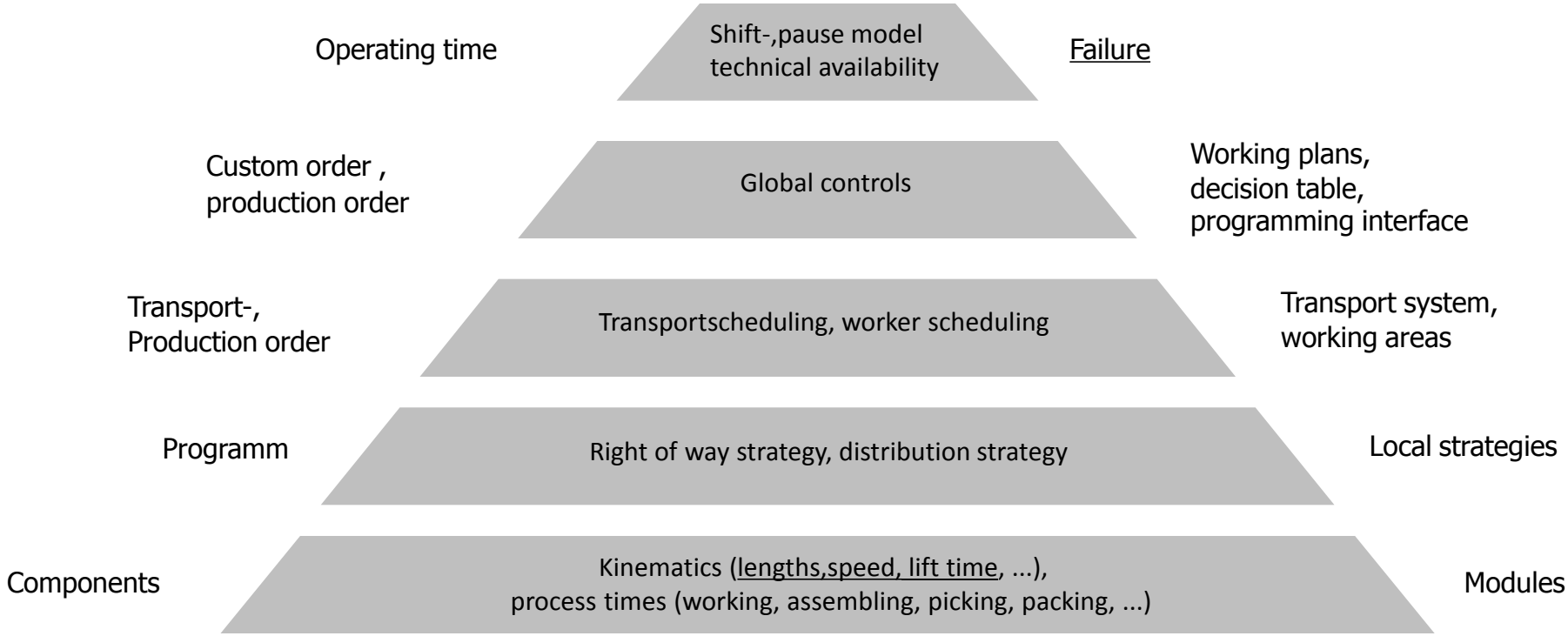
- Simulation of a planned production process
  - Delivery time
  - Throughput time

- Productions areas/Assembly lines
  - Which cycle times?
  - Where are the bottle necks?
- Material supply
- Receipt/Issue of goods, storage
  - Floor space requirements
- Worker
  - Capacity planning with
  - Multi machine operation
  - Shifts

Examples for mapping of components

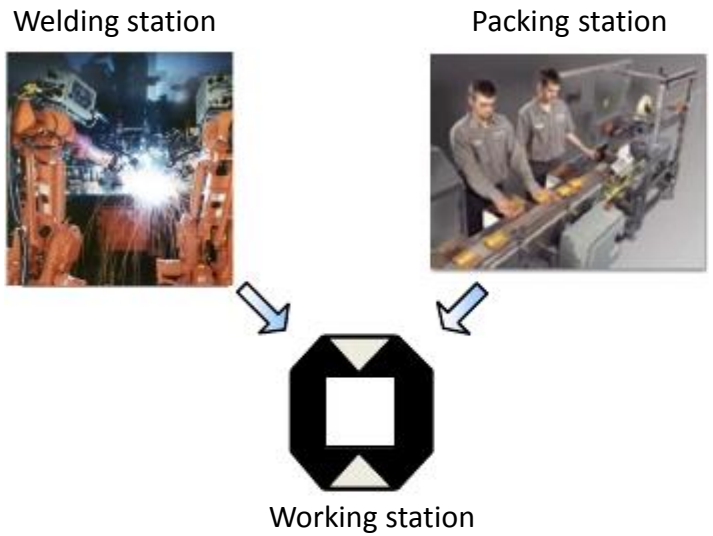
- **Storage systems**
  - Palette system
  - Carousel storage
- **Transport vehicles**
  - Fork lifts
  - Rack feeder
  - Automatic Guided vehicles (AGV)
- **Conveyor technique**
  - Roller conveyor
  - Chain conveyor
  - Power and Free

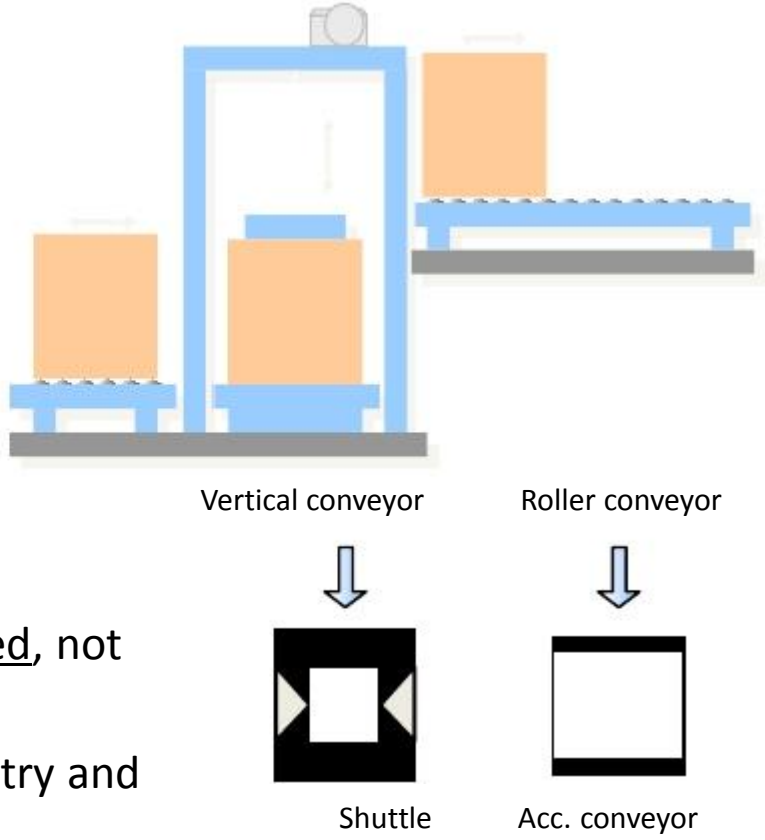
Structure Dosimis-3 – model layer



Modules

- For components of a material flow system DOSIMIS-3 offers several predefined modules.

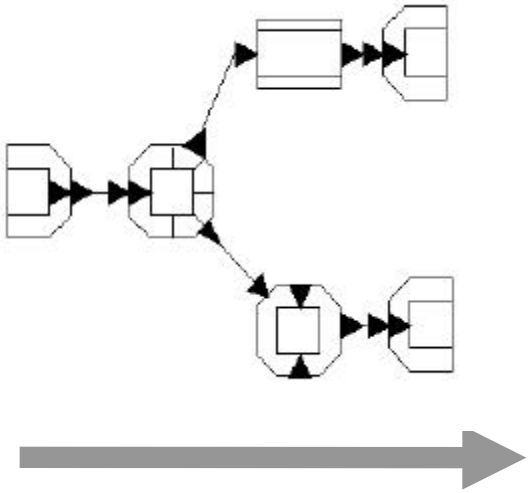




- The internal logic of a module type is predefined, not depending on the system.
- The modules will be adjusted with their geometry and strategy parameter to the concrete system.

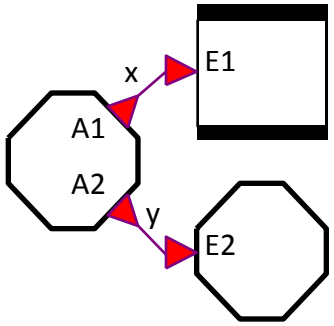
Junctions

The **direction** of the material flow is defined by the junctions between the modules.



Direction

A **junction** connects an exit of a module with an entrance of a module.



Exits: A1, A2
Entrances: E1, E2
Junction: x, y

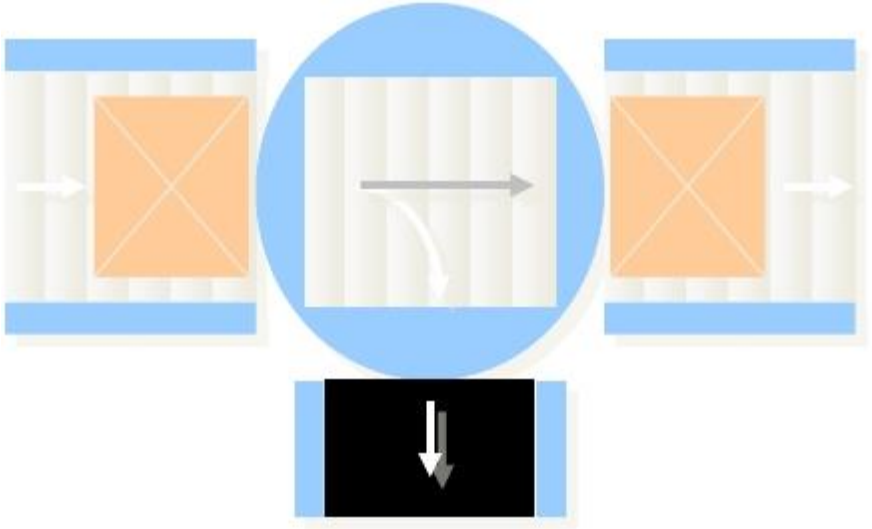
Objects

- Objects represent all elements, which pass through the defined material flow system. The system load is represented by the objects. They pass through the modules.
- Example:
  - Work pieces
  - Tools
  - Work piece holder
  - Transport equipment
  - Means of transport
- The system load describes the necessary instructions which are dispatched into the model from the start of the simulation run (e.g. material, information, work content). Objects have a type number, which can be evaluated and changed by certain modules.

Object flow

- The flow of the objects through the system is controlled by the modules parameter.
- An object can enter a module if
  - the occupation of the module is less than the capacity of the module

  AND
  - the input junction is not occupied (the last object is still entering).



DOSIMIS-3

Structure of Dosimis-3

Dosimis-3

Editor

Modeling

- Modules
- Strategies
- Failures, pauses
- Working areas
- Transport systems,
- Working plans
- Decision tables
- Excel interface
- Programming interface

Animation

- Standard-Animation
- Bitmap-Animation

Results

- Statistics
- Diagrams

Graphics

- Graphical comments
- Bitmaps

Simulator

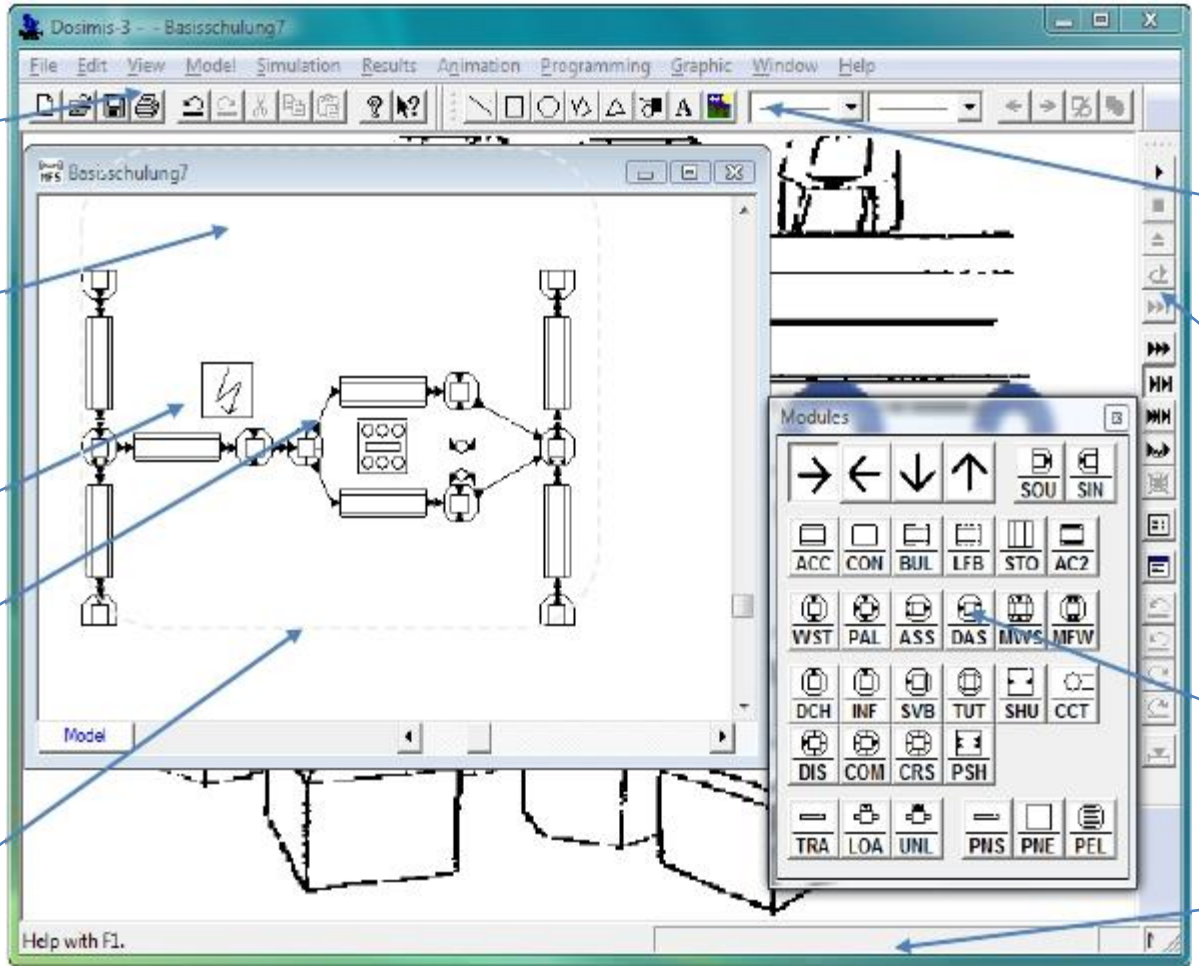
Offline Simulation

- Parameter
- Excel-interface
- COM-interface
- Optimization

Online Simulation

- Parameter
- Debug-function

DOSIMIS-3 Editor



Usage of DOSIMIS-3

Common:

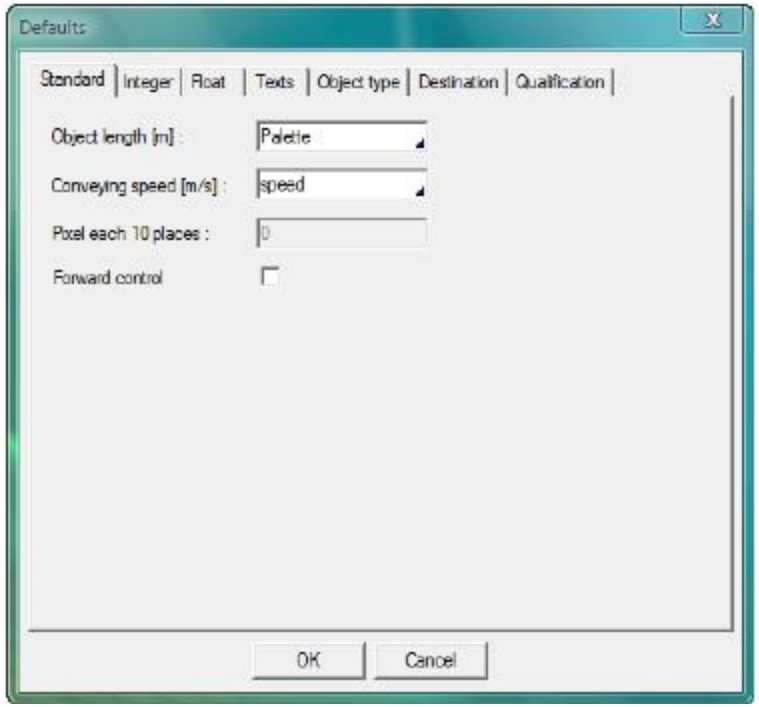
- All usable functions and short-cuts of the windows programs are also available in DOSIMIS-3.
  - Example:
    - Selection with the left mouse button
    - Right mouse button opens the context menu
    - Opening of the parameter dialog by double click (left mouse button)
  - Short-Cuts are assigned to the known functions (a list of short keys can be found in the appendix)

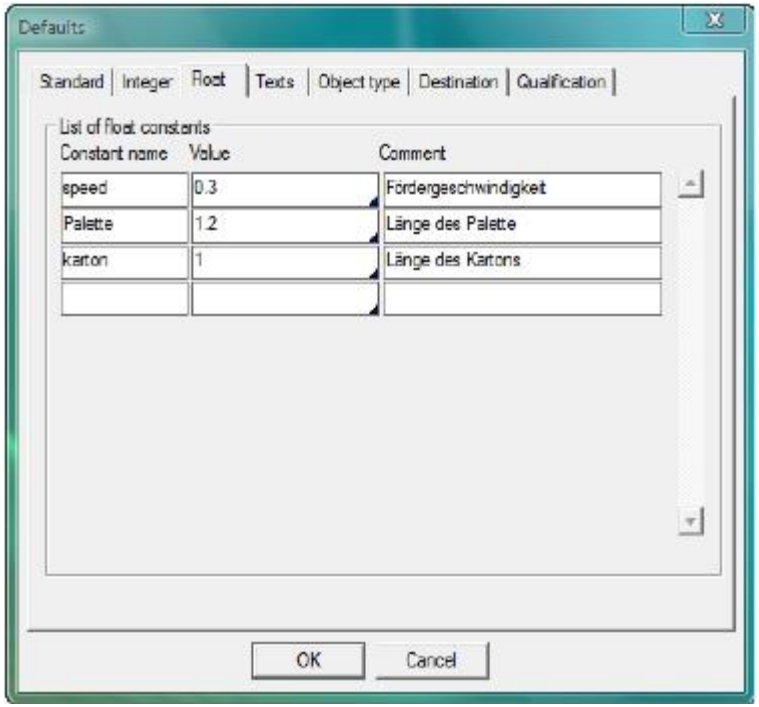
Usage of DOSIMIS-3

- Modeling
  - Inserting a module
    - Open the module palette (F2 or menu: View • Modules Palette)
    - Selection of the desired module in the palette with the left mouse button
    - The module is "adhered" at the mouse pointer
    - Place the module by clicking the left mouse button
      - Special case: conveyors are defined by several points (left mouse button for defining way points; right mouse button for end)
  - Definition of the material flow (connecting the modules)
    - Activate the connecting mode (F9 or menu: Model • Linking active)
    - Selection of the start module and the destination module with the left mouse button.
    - With the left mouse button further way points can be defined.
    - With the right mouse button the linking is terminated.

Standard parameter

- DOSIMIS-3 offers the possibility
  - To define standard values for object length and conveying speed. These values will be used when new modules are created.
  - To define and change global parameters • **Defaults**
    - Example: Speed and length of transport elements





Defaults

- Opening of the parameter dialog by
  - Menu: Model • defaults
  - In each parameter dialog of the modules this dialog can be reached by the button „Defaults“
- The following constants are available
  - Integer – constants (integer value)
  - Float – constants (real values)
  - Object type – constants (name for numerical objekt types)
  - (Transport system) Destination – constants (name for numerical destination constants)
  - (Worker) Qualification – constants (name for the qualification)

DOSIMIS-3 Modules

- Basic modules
  - Source (SOU)
  - Sink (SIN)
  - Working station(WST)
  - Accumulating Conveyor (ACC)
  - Distributor (DIS)
  - Combining station (COM)
  - Assembly station (ASS)
  - Disassembly station (DAS)
  - Break (BRK)
  - Work area(WRA)
- Further modules
  - Conveyor (CON)
  - Crossing (CRO)
  - Shuttle (SHU)
  - Capacity monitoring (CPM)

Function keys

- Function keys
  - F1: Open / Close of online-help
  - F2: Open / Close of modules palette
  - Strg + F2: Open / Close of control palette
  - Shift + F2: Open / Close of graphic toolbar
  - F3: Open of search dialog
  - F5: Redraw workarea
  - F7: Start of simulation (offline)
  - Strg + F7: Start / End of online simulation
  - Alt + F7: Open simulation parameter
  - F9: Connecting mode
  - F11: Start of animation
  - Shift + F11:Open / Close of animation toolbar
  - Alt + F11: Open animation parameter

Short-Cuts

- Short - Cuts
  - Ctrl + A: Select all
  - Ctrl + C: Copy selected elements to the clipboard
  - Ctrl + X: Copy selected elements to the clipboard and erase them from the model.
  - Ctrl + V: Paste from clipboard.
  - Ctrl + D: Duplicate selection
  - Ctrl + I: Insert another model
  - Ctrl + M: Move
  - Ctrl + R: Rotate (left)
  - Ctrl + W: Mirror

- Short - Cuts
  - Ctrl + F: Open search dialog
  - Ctrl + P: Open parameter dialog
  - Ctrl + S: Save the model
  - Shift + F: Zoom-Window
  - Shift + M: Show complete model
  - Shift + B: Export actual view in bitmap format

File formats of DOSIMIS-3

- **The complete information about the model is saved in three files:**
  - [Modelname].mfs - m*aterial flow file*
    - Contains all information of elements and strategies.
  - [Modelname].dar - *representation file*
    - Contains the coordinates of the elements on the desktop
  - [Modelname].dxg - graphic file
    - Contains all information about the graphical comments
- Further files are created after processing the model and during or after the execution of the simulation.

Modules – Source (SOU)

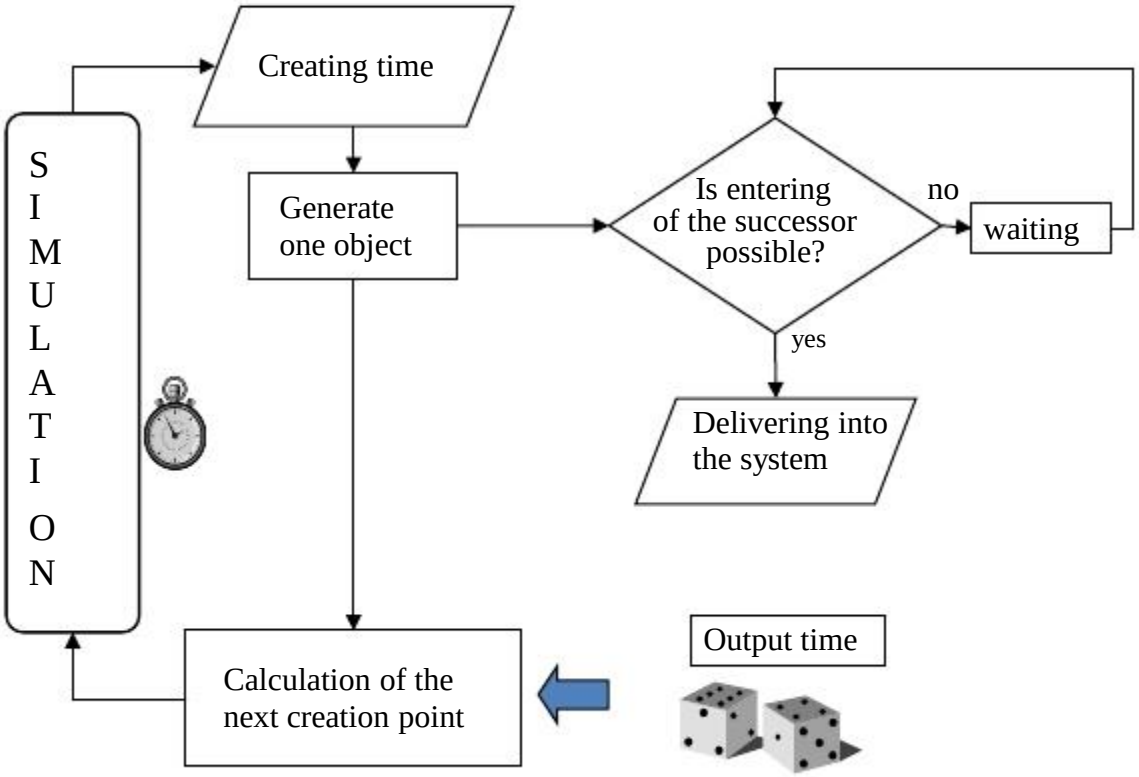
Function

Interface module

The source generates objects and delivers them to the successor.

e.g. receipt of goods

Flow chart



Modules - Sink (SIN)

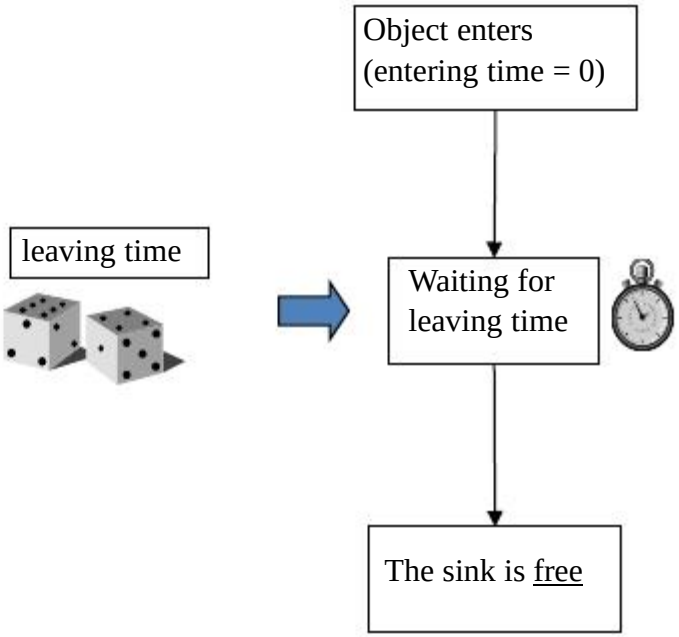
Function

Interface module

The objects leave the system.

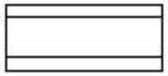
e.g. issue of goods

Flow chart



Modules – Accumulating Conveyor (ACC)

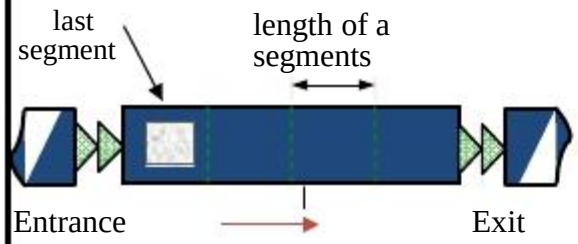
Function



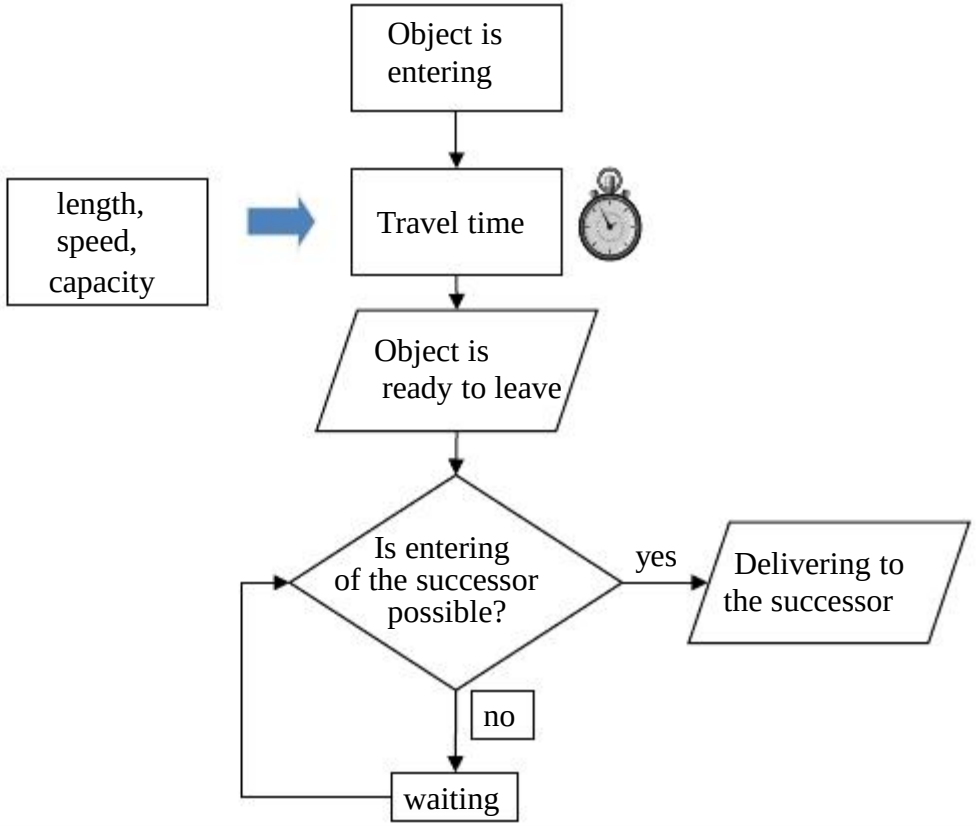
FIFO – principle

Transport and storing

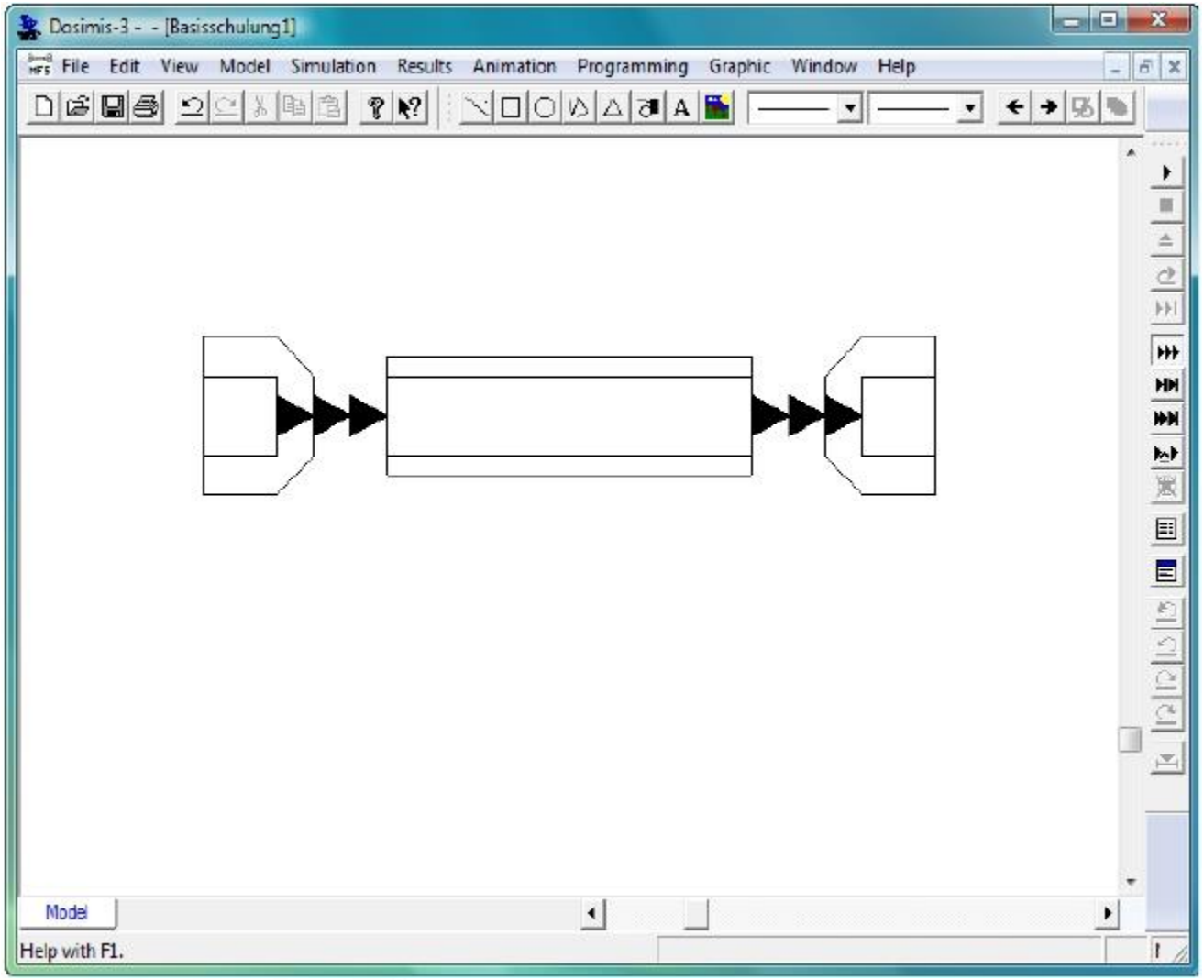
e.g. roller conveyor, chute



Flow chart



Demo model 1 – Step 1



Demo model - Parameter

- Defaults
  - Object length: 1.2 m
  - Speed: 0.3 m/s
  - Product:
    - Article A: Object type 10 (Type_A)
    - Article B: Object type 20 (Type_B)
    - Stack A: Object type 110 (Stack_A)
    - Stack B: Object type 120 (Stack_B)
    - Emptpal: Object type 99

Demo model 1 – Parameter 1

- Source „SOU_Demo_1“:
  - Object generation: random sequence 2 products (Article A & B), 1:1
  - Distribution: normal distributed
    - Mean value: 60 sec
    - Deviation: 5 sec
- Accumulating conveyor „ACC_Demo_1:
  - Capacity: 5
  - Segment length: 1.2 m
  - Speed: 0.3 m/s
- Sink „SIN _Demo_1 :
  - Leaving time:
    - Kind of distribution: exponential distributed
    - Mean value: 60 sec

Simulation run/Experiment

Before the simulation run you have to check the model for faults. If any element has a wrong parameter or any information is still missing (e.g. length or speed of a conveyor) it will be impossible to start a run. The module(s) will be drawn green or red after running the consistency check.

To open the simulation parameter dialog you have to press ALT+F7 or select "Simulation" • "Parameter" in the menu bar. In this parameter dialog you have to define:

- simulation time
- pre-run time
- the length of the statistic interval.

Furthermore you are able to select different statistic files, to exclude the work areas, to disable failures and to fix all cycle times.

To start a simulation run press "F7" or select "Simulation" • "Start". After starting the run, a dialog is opened displaying the state and the simulation time of this simulation run.

Simulation run/Experiment

Selection of worker animation and excluding of worker scheduling

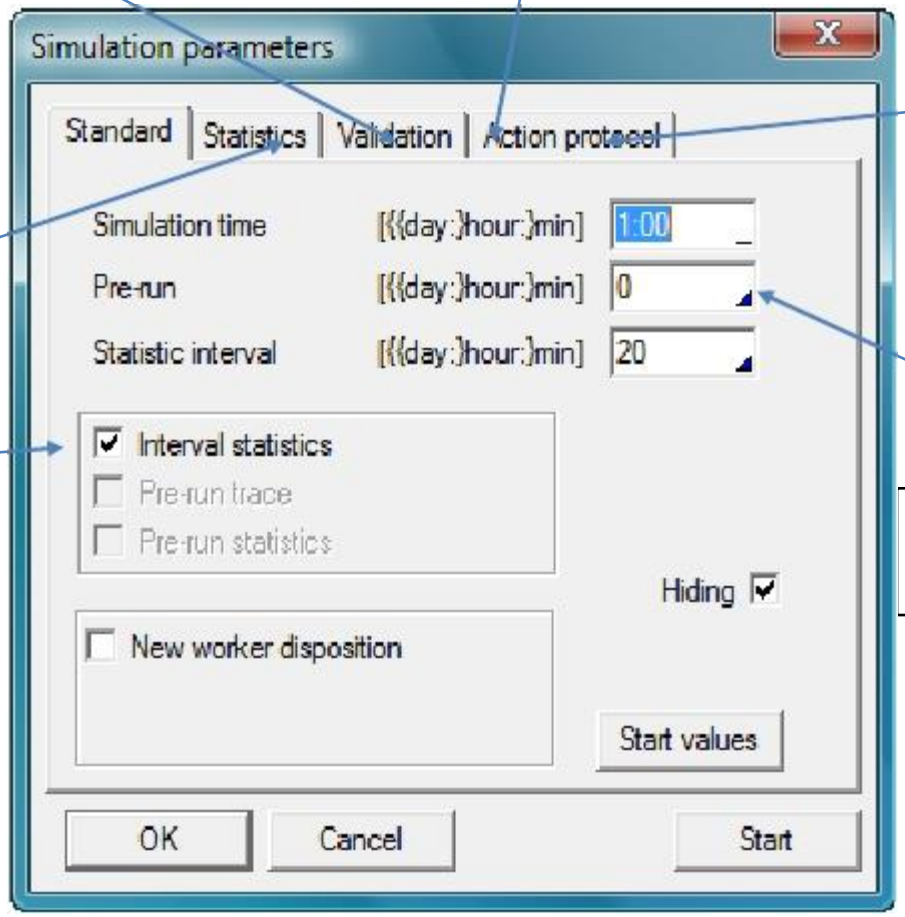
Excluding of failures/maintenance /pauses/working pauses and random processes

Definition of protocol contents

Selection of different statistics

Selection of different statistic files

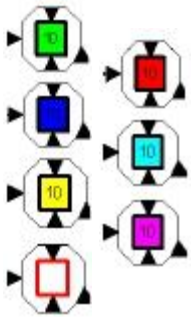
Simulation time/ pre-run/statistic interval
Format: In minutes or dd:hh:mm



Animation

To visualize the events of a simulation run, the animation can be used. During the animation the types of the objects, that in the modules, are shown. Additionally the state of these objects is marked by different colors:

State of the object	animation color
• transport	green
• blockage	red
• In process	blue
• setup	light blue
• Waitingfor worker	yellow
• Waitingfor setup worker	cyan
• Object is leaving the module	red border

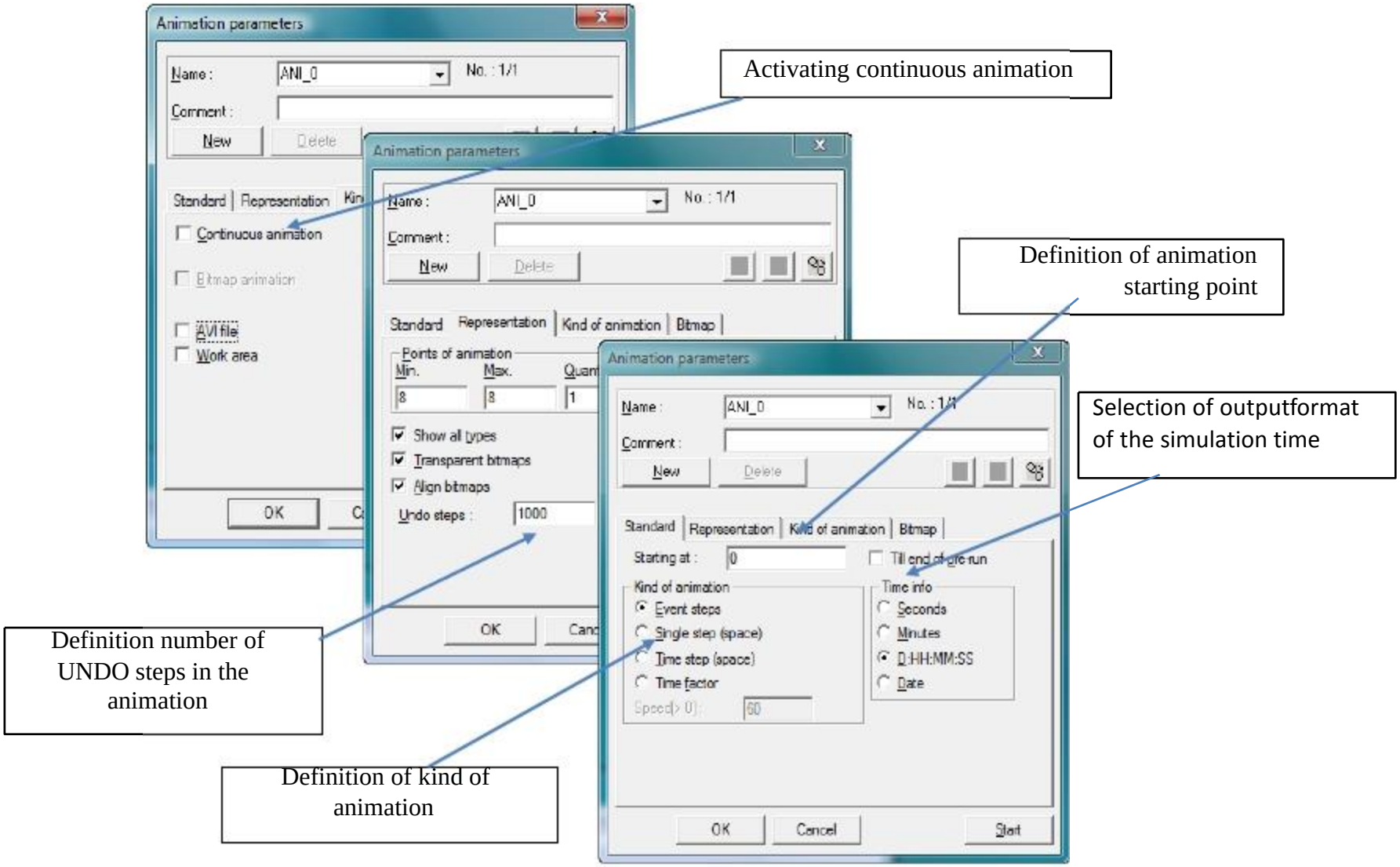


Start of animation by:

- F11
- Menu: Animation • Start
- In the dialog „Animation parameter“ by button „Start“
- Button ( ) of the animation toolbar

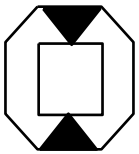
During the standard animation the movements inside the modules are not shown. A continuous motion will be realized by the continuous animation.

Animations parameter



Modules– Workstation (WST)

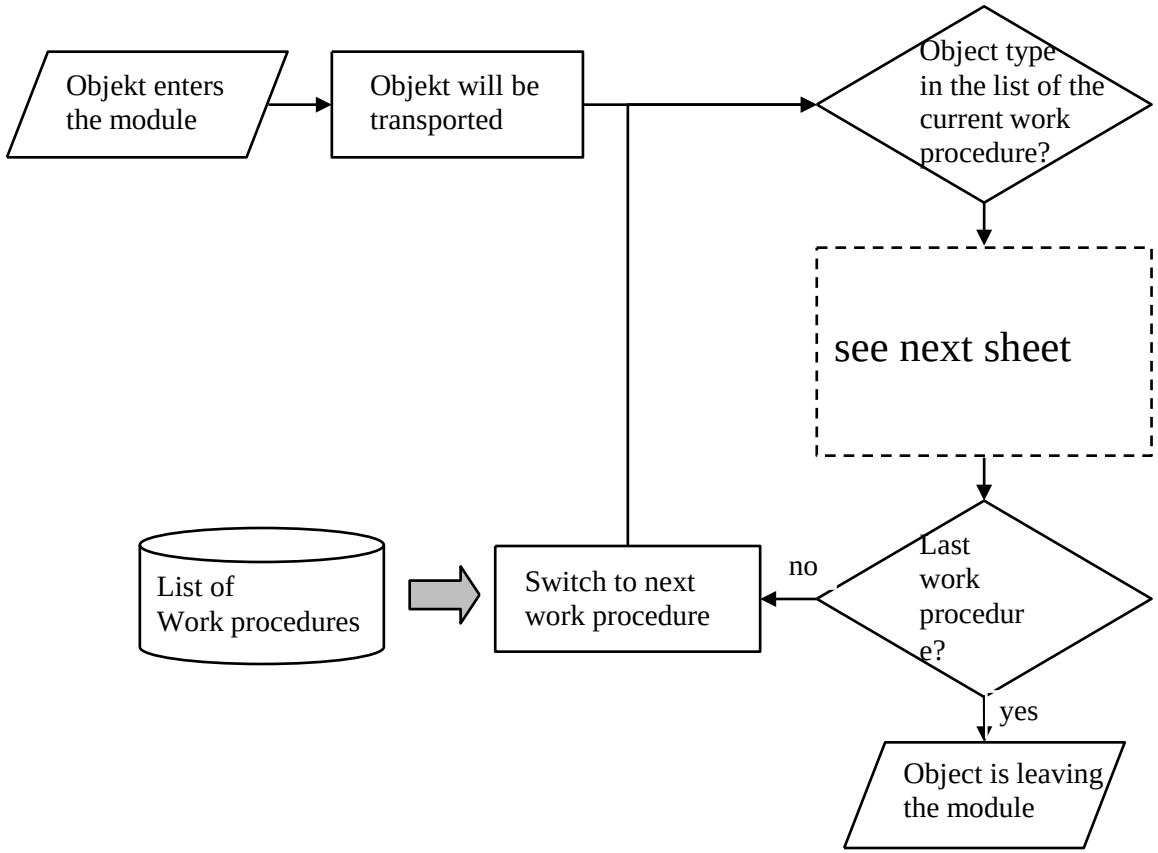
Function



Processing an object

e.g. machine, I-points, quality control...

Flow chart

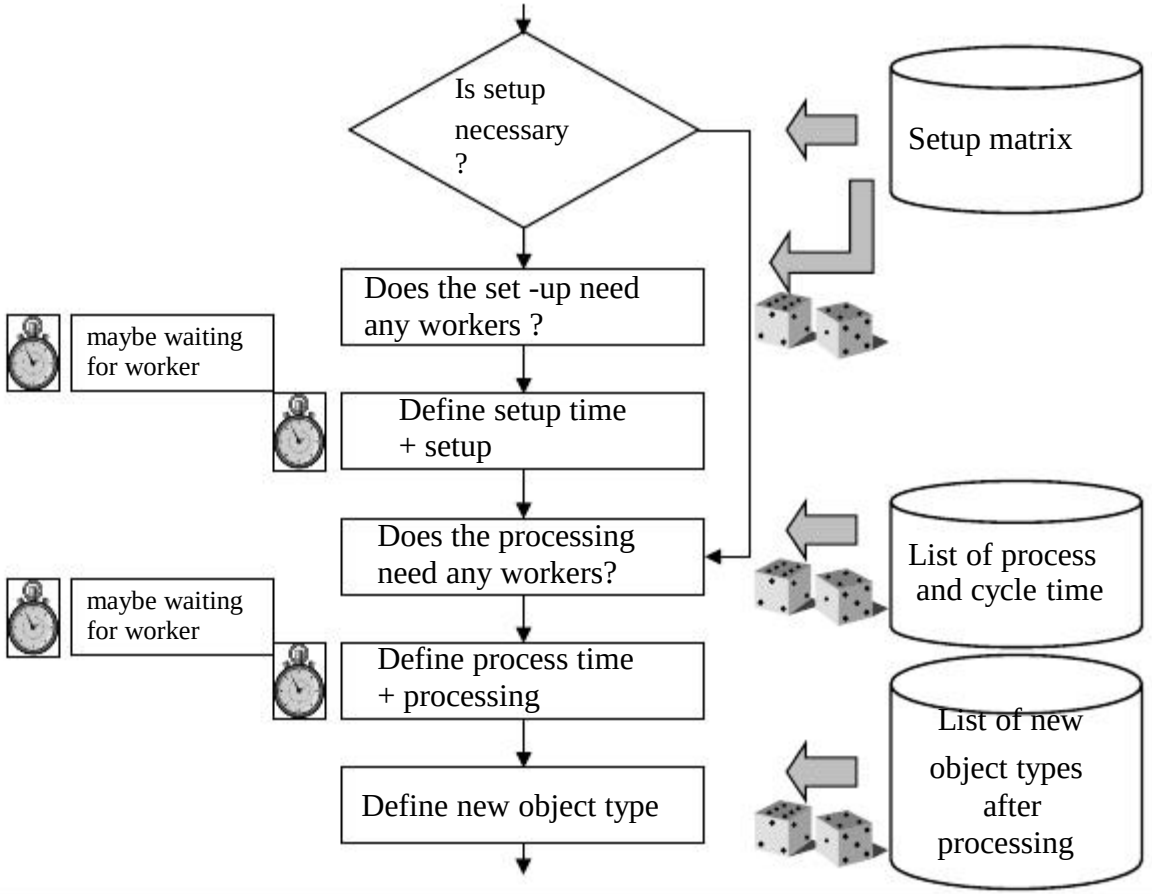


Modules– Workstation (WST)

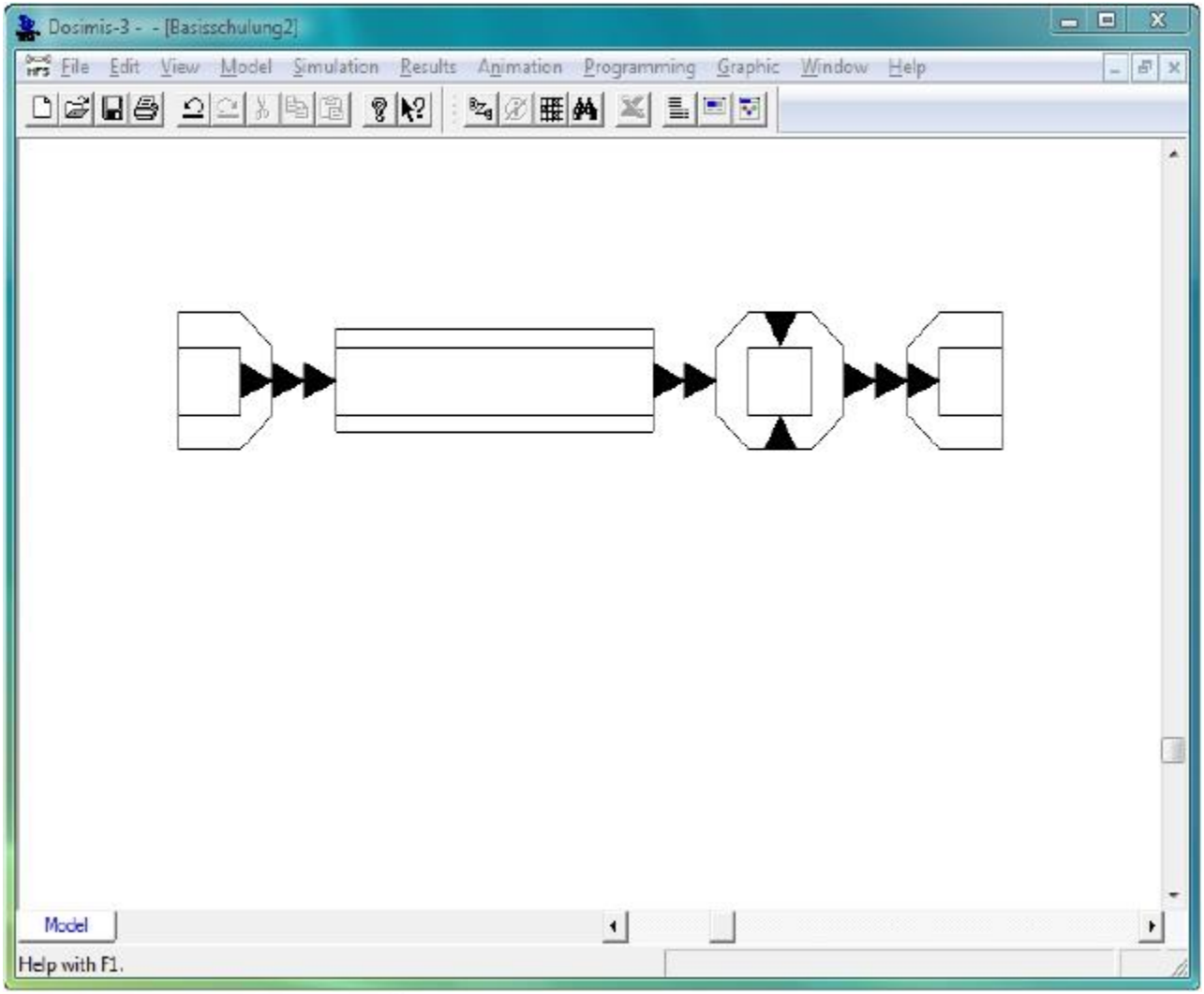
Properties

- There is at least one work procedure to be defined.
  You have to define a list of object types with the cycle time for each object type.
- If an object type is not defined in this list, the object will only be transported through this station.
- It is possible to use statistical distribution and to add any number of workers for this process.

Flow chart - Detail



Demo model– Step 2

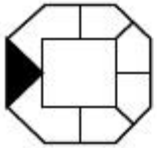


Demo model– Parameter 2

- Workstation „WST_Demo_1“:
  - Article A
    - Process time
      - Distribution — normal distributed
      - Mean value — 60 sec
      - Deviation — 6 sec
  - Article B
    - Process time
      - Distribution — uniformly distributed
      - Lower limit — 50 sec
      - Upper limit — 70 sec
  - Both workstations have a length of 1.2 m and a speed of 0.3 m/s
  - There is no employment of workers and no setup necessary.

Modules– Distributor (DIS)

Function

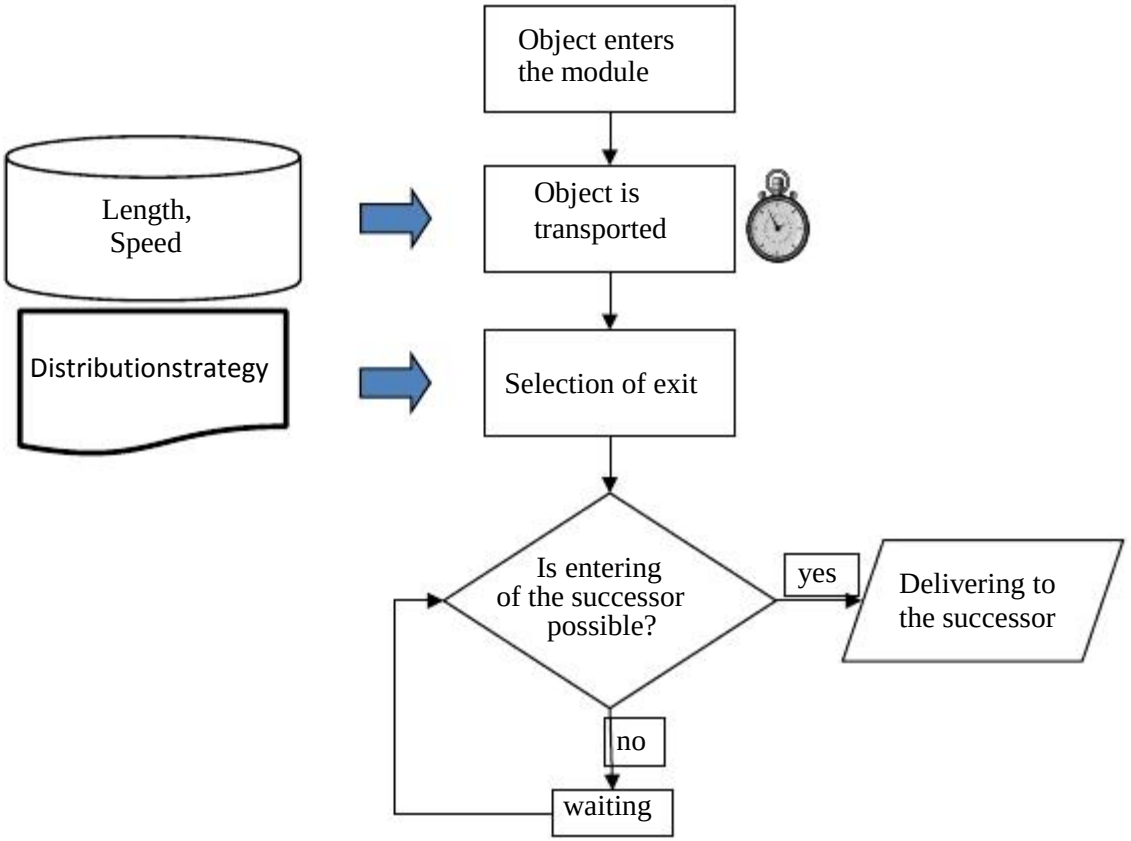


Distribute

Distribution of the object flow among any number of exits.

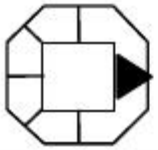
- The capacity of the distributor is one.
- The destination will be defined after the travel time

Flow chart



Modules– Combining Station (COM)

Function

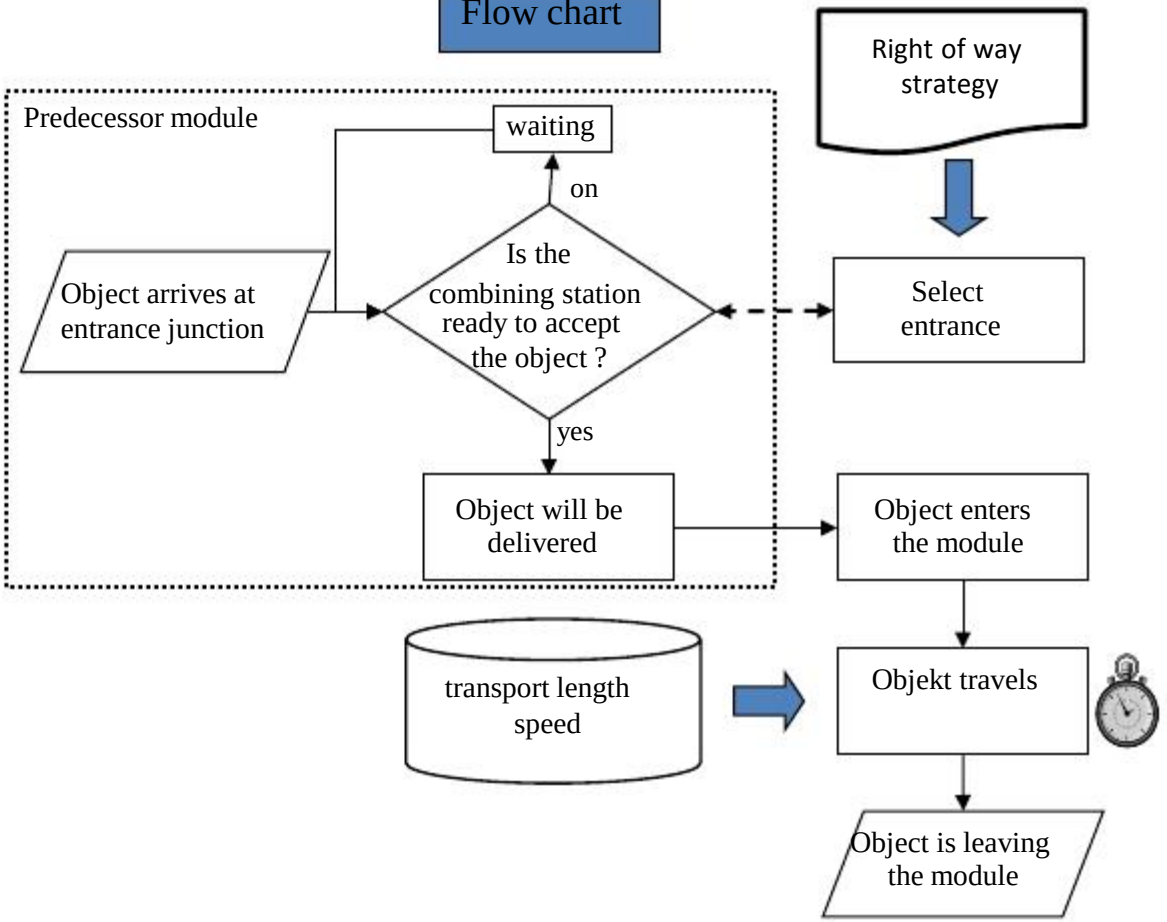


Combining

Combining of the object flow among any number of entrances

- The capacity of a combining element is one.
- The right of way strategy will only be evaluated, if more than one object is waiting at the entrances.

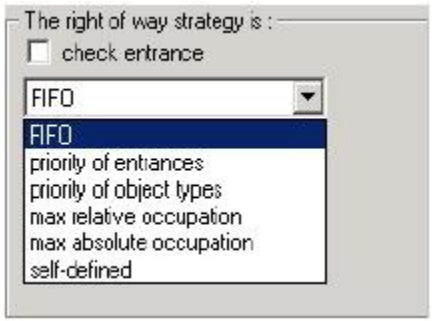
Flow chart

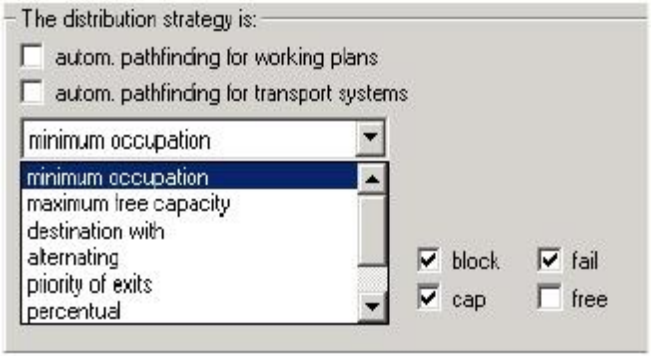


Right of way- and distribution strategy

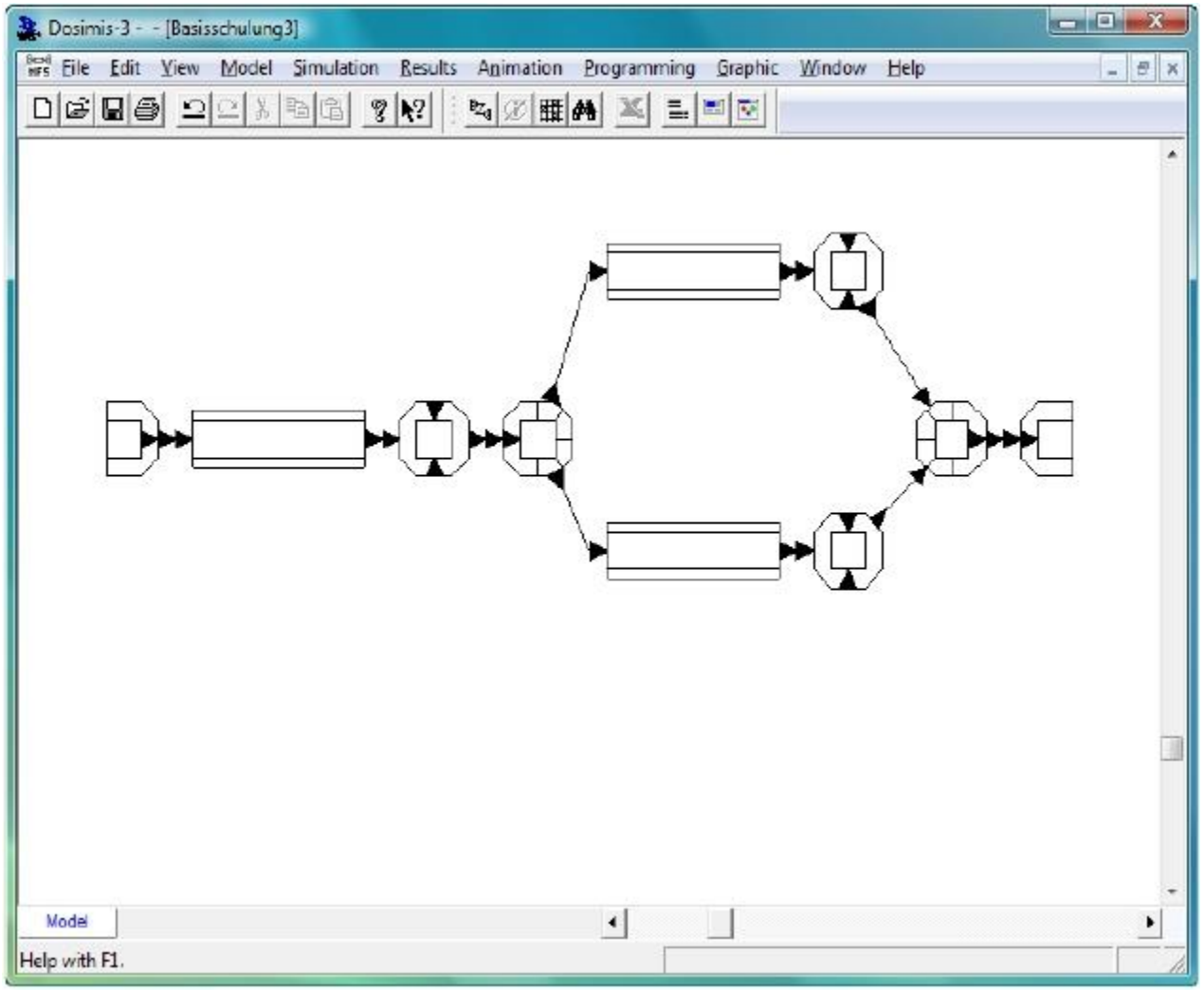
DOSIMIS-3 offers several strategies to divide or merge the material flow. The following strategies are offered by the selection box:

- Right of way strategies
  - FIFO
  - Priority of entrances
  - Priority of object types
  - Maximum relative occupation
  - Maximum absolute occupation
  - Self defined
- Distribution strategies
  - Minimum occupation
  - Maximum free capacity
  - Alternating
  - Priority of exits
  - Percentual
  - Bauschuld
  - Destination with
  - Self defined





Demo model– Step 3



Demo model – Parameter 3

- Duplicate buffer and working station twice
- Distribution element „DIS_DEMO“
  - Distribution strategy
    - Minimum occupation

    or
    - Destination with object type
- Combining element „COM_DEMO“
  - Right of way strategy
    - FIFO